WHAT IS CLAIMED IS:

1. A plasma processing apparatus comprising:

a single carrier source adapted to generate a first RF signal at a carrier frequency;

a modulation source adapted to generate a second RF signal at a modulation frequency;

a modulator adapted to modulate the first RF signal with the second RF signal to form an amplitude modulated signal, wherein the amplitude modulated signal contains peaks with amplitudes greater than or less than amplitudes of the peaks of the first RF signal; and

a plasma processing chamber coupled to the modulator.

2. The apparatus of claim 1 further comprising:

a power amplifier adapted to amplify the amplitude modulated signal from the modulator to generate a high power amplitude modulated signal.

3. The apparatus of claim 1 further comprising:

a transmission line for transmitting the amplitude modulated signal; and

a single impedance matching network, wherein the single matching network is adapted to receive the amplitude modulated signal and provides impedance matching from the transmission line to the plasma.

4. The apparatus of claim 1 wherein the modulation source is further adapted to generate a third frequency modulating RF signal, and the modulator is further adapted to modulate the first RF signal with the second RF signal and the third RF signal to form an amplitude and frequency modulated signal.

5. The apparatus of claim 1 wherein the second RF signal is in the form of a sine wave.

6. The apparatus of claim 1 wherein the apparatus is an etching apparatus.

7. A plasma processing apparatus comprising:

a carrier source adapted to generate a first RF signal at a carrier frequency;

a modulation source adapted to generate a second RF signal at a modulation frequency;

a modulator adapted to modulate the first RF signal with the second RF signal to form a frequency modulated signal; and

a plasma processing chamber coupled to the modulator.

8. The apparatus of claim 7 further comprising:

an amplifier adapted to amplify the frequency modulated signal to generate a high power frequency modulated signal.

9. The apparatus of claim 7 further comprising:

a transmission line for transmitting the frequency modulated signal; and

a single matching network adapted to receive the frequency modulated signal to provide impedance matching from the transmission line to a plasma.

10. The apparatus of claim 7 wherein the modulation source is further adapted to generate a third RF signal at an amplitude modulation frequency, and wherein the modulator is further adapted to modulate the first RF signal with the second RF signal and the third RF signal to form an frequency and amplitude modulated signal.

11. The apparatus of claim 7 wherein the second RF signal is in the form of a sine wave.

12. The apparatus of claim 7 wherein the apparatus is an etching apparatus.

13. The apparatus of claim 7 wherein the modulation frequency is less than about 0.1 times the carrier frequency.

14. A method of delivering power to a plasma processing chamber, the method comprising:

generating a first RF signal at a carrier frequency;

generating a second RF signal at a modulating frequency;

forming an amplitude modulated signal by modulating the first RF signal with the second RF signal, wherein the amplitude modulated signal contains peaks with amplitudes greater than or less than amplitudes of peaks of the first RF signal; and

delivering only the amplitude modulated signal to a reactant gas within the plasma processing chamber to form a plasma.

15. The method of claim 14 further comprising, prior to generating the plasma:

amplifying the amplitude modulated signal to form a high power amplitude modulated power signal, and wherein

delivering plasma within the plasma processing chamber using the amplitude modulated signal comprises using the high power amplitude modulated signal to generate the plasma.

16. The method of claim 14 wherein the second RF signal has a lower frequency than the first RF signal.

17. The method of claim 14 wherein forming an amplitude modulated signal comprises:

forming an amplitude and frequency modulated RF signal with the second RF signal and a third frequency modulating RF signal.

18. The method of claim 14 further comprising:

modifying the amplitude modulated signal by adjusting a modulation index.

19. The method of claim 14 wherein the second RF signal comprises a signal of form $\beta\sin(\omega_m t)$, wherein β is a modulation index and is less than or equal to 1, ω_m is the modulating frequency, and t is time.

20. The method of claim 14 wherein the amplitude modulated signal is of the form $E_o[1+\beta\sin(\omega_m t)]\sin(\omega_c t)$ wherein β is a modulation index, ω_m is the modulating frequency, ω_c is the modulation, E_o is an initial electric field, and t is time.

21. The method of claim 14 further comprising passing the amplitude modulated signal through an impedance matching network.

22. The method of claim 14 wherein second RF signal is in the form of a sine wave.

23. A method of delivering radio frequency (RF) power to a plasma, the method comprising:

generating a first RF signal at a carrier frequency;

generating a second RF signal at a modulation frequency;

forming a frequency modulated signal by modulating the first RF signal with the second RF signal; and

generating a plasma within the plasma processing chamber using the frequency modulated signal.

24. The method of claim 23 further comprising:

amplifying the frequency modulated signal to generate a frequency modulated power signal, and

wherein generating a plasma comprises using the frequency modulated power signal to generate a plasma.

25. The method of claim 23 wherein forming the frequency modulated signal comprises:

forming a frequency and amplitude modulated signal by modulating the first RF signal with the second RF signal, and a third amplitude modulating signal.

26. The method of claim 23 wherein the modulation frequency is less than about 0.1 times the carrier frequency.

27. The method of claim 23 wherein the frequency modulated power signal is of the form $E(\omega_c,t) = E_o[\exp(i\omega_c t)]\exp[i\beta\sin(\omega_m t)]$.

28. The method of claim 23 wherein the carrier frequency is 13.56 MHz.

29. The method of claim 23 further comprising passing the frequency modulated signal through an impedance matching network.

30. The method of claim 23 wherein the second RF signal is in the form of a sine wave.

31. A power system for a plasma processing apparatus, the power system comprising:

a single carrier source adapted to generate a first RF signal at a carrier frequency;

a modulation source adapted to generate a second RF signal at a modulation frequency; and

a modulator adapted to modulate the first RF signal with the second RF signal to form an amplitude modulated signal, wherein the amplitude modulated signal contains peaks with amplitudes greater than or less than amplitudes of the peaks of the first RF signal.

32. A power system for a plasma processing apparatus, the power system comprising:

a carrier source adapted to generate a first RF signal at a carrier frequency;

a modulation source adapted to generate a second RF signal at a modulation frequency; and

a modulator adapted to modulate the first RF signal with the second RF signal to form a frequency modulated signal.